

IN THE CLAIMS

The following listing of the claims is provided in accordance with 37 C.F.R.

1.121:

1. (original) An apparatus for controlling a railway consist, said apparatus comprising:
 - a consist model adapted for computing an objective function from a set of candidate driving plans and a set of model parameters;
 - a parameter identifier adapted for calculating said model parameters from a set of consist measurements; and
 - a trajectory optimizer adapted for generating said candidate driving plans and for selecting an optimal driving plan to optimize said objective function subject to a set of terminal constraints and operating constraints.
2. (original) The apparatus of claim 1 further comprising a pacing control system adapted for generating a set of throttle commands from said optimal driving plan and said consist measurements.
3. (original) The apparatus of claim 1 further comprising a display module adapted for displaying a formatted driving plan from said optimal driving plan and said consist measurements.
4. (original) The apparatus of claim 1 wherein said parameter identifier comprises an extended Kalman filter.
5. (original) The apparatus of claim 4 wherein:
 - said extended Kalman filter has an extended filter state vector comprising a consist position estimate, a consist speed estimate, and said model parameters; and

said consist measurements comprise a consist position measurement and a consist speed measurement.

6. (original) The apparatus of claim 1 wherein said parameter identifier comprises:

a Kalman filter adapted for generating a set of filter outputs from said consist measurements; and

a least squares estimator adapted for estimating said model parameters from said filter outputs and said consist measurements.

7. (original) The apparatus of claim 6 wherein:

said Kalman filter has a filter state vector comprising a consist position estimate, a consist speed estimate, and a consist acceleration estimate;

said filter outputs comprise said consist speed estimate and said consist acceleration estimate; and

said consist measurements comprise a consist position measurement, a consist speed measurement, a tractive effort signal, and a track grade signal.

8. (original) The apparatus of claim 1 wherein said objective function is a quantity or linear combination of quantities selected from the group consisting of fuel consumption, travel time, integral squared input rate, and summed squared input difference.

9. (currently amended) An apparatus for controlling a railway consist, said apparatus comprising:

a consist model adapted for computing an objective function from a set of candidate driving plans and a set of model parameters;

a parameter identifier adapted for calculating said model parameters from a set of consist measurements;

a trajectory optimizer adapted for generating said candidate driving plans and for selecting an optimal driving plan to optimize said objective function subject to a set of terminal constraints and operating constraints; and

a display module adapted for displaying a formatted driving plan from said optimal driving plan and said consist measurements,

said objective function being a quantity or ~~linear~~ a combination of quantities selected from the group consisting of fuel consumption, travel time, integral squared input rate, and summed squared input difference.

10. (original) The apparatus of claim 9 further comprising a pacing control system adapted for generating a set of throttle commands from said optimal driving plan and said consist measurements.

11. (original) The apparatus of claim 9 wherein said parameter identifier comprises an extended Kalman filter.

12. (original) The apparatus of claim 11 wherein:
said extended Kalman filter has an extended filter state vector comprising a consist position estimate, a consist speed estimate, and said model parameters, and
said consist measurements comprise a consist position measurement and a consist speed measurement.

13. (original) The apparatus of claim 9 wherein said parameter identifier comprises:

a Kalman filter adapted for generating a set of filter outputs from said consist measurements; and

a least squares estimator adapted for estimating said model parameters from said filter outputs and said consist measurements.

14. (original) The apparatus of claim 13 wherein:
said Kalman filter has a filter state vector comprising a consist position estimate, a consist speed estimate, and a consist acceleration estimate;
said filter outputs comprise said consist speed estimate and said consist acceleration estimate, and
said consist measurements comprise a consist position measurement, a consist speed measurement, a tractive effort signal, and a track grade signal.

15. (original) A method for controlling a railway consist, said method comprising:
computing an objective function from a set of candidate driving plans and a set of model parameters;
calculating said model parameters from a set of consist measurements; and
generating said candidate driving plans and selecting an optimal driving plan to optimize said objective function subject to a set of terminal constraints and operating constraints.

16. (original) The method of claim 15 further comprising generating a set of throttle commands from said optimal driving plan and said consist measurements.

17. (original) The method of claim 15 further comprising displaying a formatted driving plan from said optimal driving plan and said consist measurements.

18. (original) The method of claim 15 wherein said act of calculating said model parameters comprises using an extended Kalman filter.

19. (original) The method of claim 18 wherein:
said extended Kalman filter has an extended filter state vector comprising a consist position estimate, a consist speed estimate, and said model parameters; and

said consist measurements comprise a consist position measurement and a consist speed measurement.

20. (original) The method of claim 15 wherein said act of calculating said model parameters comprises:

using a Kalman filter for generating a set of filter outputs from said consist measurements; and

using a least squares estimator for estimating said model parameters from said filter outputs and said consist measurements.

21. (original) The method of claim 20 wherein:

said Kalman filter has a filter state vector comprising a consist position estimate, a consist speed estimate, and a consist acceleration estimate;

said filter outputs comprise said consist speed estimate and said consist acceleration estimate; and

said consist measurements comprise a consist position measurement, a consist speed measurement, a tractive effort signal, and a track grade signal.

22. (original) The method of claim 15 wherein said objective function is a quantity or linear combination of quantities selected from the group consisting of fuel consumption, travel time, integral squared input rate, and summed squared input difference.

23. (currently amended) A method for controlling a railway consist, said method comprising:

computing an objective function from a set of candidate driving plans and a set of model parameters;

calculating said model parameters from a set of consist measurements;

generating said candidate driving plans and selecting an optimal driving plan to optimize said objective function subject to a set of terminal constraints and operating constraints; and

displaying a formatted driving plan from said optimal driving plan and said consist measurements,

said objective function being a quantity or ~~linear~~ a combination of quantities selected from the group consisting of fuel consumption, travel time, integral squared input rate, and summed squared input difference.

24. (original) The method of claim 23 further comprising generating a set of throttle commands from said optimal driving plan and said consist measurements.

25. (original) The method of claim 23 wherein said act of calculating said model parameters comprises using an extended Kalman filter.

26. (original) The method of claim 25 wherein:
said extended Kalman filter has an extended filter state vector comprising a consist position estimate, a consist speed estimate, and said model parameters; and
said consist measurements comprise a consist position measurement and a consist speed measurement.

27. (original) The method of claim 23 wherein said act of calculating said model parameters comprises:

using a Kalman filter for generating a set of filter outputs from said consist measurements, and

using a least squares estimator for estimating said model parameters from said filter outputs and said consist measurements.

28. (original) The method of claim 27 wherein:

said Kalman filter has a filter state vector comprising a consist position estimate, a consist speed estimate, and a consist acceleration estimate;

said filter outputs comprise said consist speed estimate and said consist acceleration estimate; and

said consist measurements comprise a consist position measurement, a consist speed measurement, a tractive effort signal, and a track grade signal.